

DEPARTMENT OF THE ARMY  
TECHNICAL MANUAL

100  
TM 11-2413

DEPARTMENT OF THE AIR  
FORCE TECHNICAL ORDER

TO 31M1-2TM-121

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HYDROGEN  
GENERATOR  
ML-303/TM AND  
HYDROGEN  
GENERATOR SET  
AN/TMQ-3

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DEPARTMENTS OF THE ARMY AND THE AIR FORCE

AUGUST 1956

## **WARNING**

### **HYDROGEN IS A HIGHLY FLAMMABLE GAS**

Mixtures of hydrogen and air can be highly explosive. Never smoke near a place where hydrogen is generated. Remove all possible sources of flames and sparks.

### **DANGEROUS HEAT AND CHEMICAL REACTION MAY RESULT FROM INCORRECT OPERATION OF THIS EQUIPMENT**

Removing the generator from the water while in operation will produce excessive heat and may cause dangerous chemical reaction. If a balloon breaks during inflation, or if for any other reason inflation must be interrupted, keep the generator in the water until the generation of hydrogen has stopped. Never remove the generator from the water while in operation.

### **DON'T TAKE CHANCES**

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# HYDROGEN GENERATOR ML-303/TM AND HYDROGEN GENERATOR SET AN/TMQ-3

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\*This manual supersedes TM 11-2413, 3 April 1945, including C 1, 29 November 1945; C 2, 12 July 1946; and C 3, 14 April 1954.

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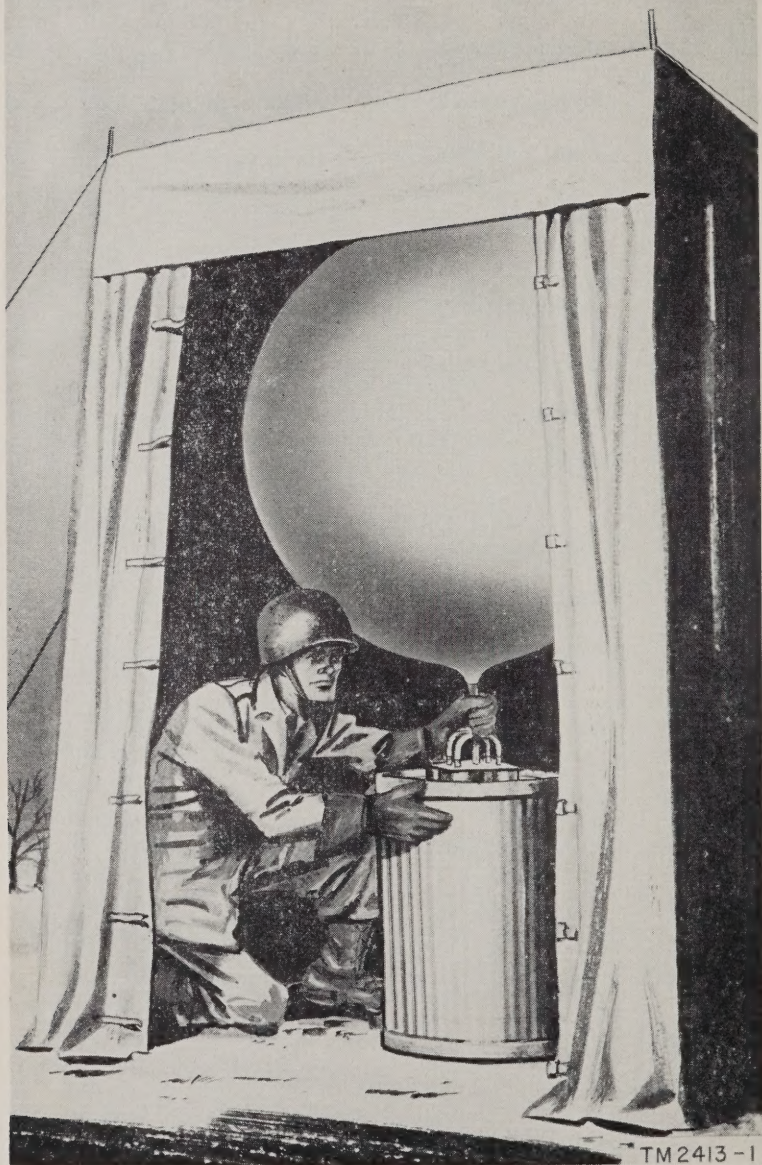
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*Figure 1. Hydrogen Generator Set AN/TMQ-3 in operation.*

# CHAPTER 1

## INTRODUCTION

### Section I. GENERAL

#### 1. Scope

a. This manual provides instructions for the installation, operation, and maintenance of Hydrogen Generator ML-303/TM and Hydrogen Generator Set AN/TMQ-3.

b. Forward comments on this publication directly to: Commanding Officer, The Signal Corps Publications Agency, Fort Monmouth, New Jersey.

#### 2. Forms and Records

a. *Unsatisfactory Equipment Reports.*

(1) Fill out and forward DA Form 468 (Unsatisfactory Equipment Report) to Commanding General, Signal Corps Engineering Laboratories, Fort Monmouth, New Jersey, as prescribed in AR 700-38.

(2) Fill out and forward DD Form 535 (Unsatisfactory Report) to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in AF TO 00-35D-54.

b. *Report of Damaged or Improper Shipment.* Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700-58 (Army); Navy Shipping Guide, Article 1850-4 (Navy); and AFR 71-4 (Air Force).

### Section II. DESCRIPTION AND DATA

#### 3. Purpose and Use

Hydrogen Generator ML-303/TM and Hydrogen Generator Set AN/TMQ-3 are used in the inflation of meteorological balloons. The equipment is transportable and is intended for use in the field.

#### 4. Technical Characteristics

a. *Hydrogen Generator ML-303/TM.*

Calc'um hydride charge used	Hydrogen generating capacity (cu ft)	Time required (minutes)
ML-304A/TM -----	6	4 ½
ML-305A/TM -----	24	15



*b. Hydrogen Generator Set AN/TMQ-3.*

- (1) *Generating capacity.* When using four calcium hydride charges ML-305A/TM, Hydrogen Generator Set AN/TMQ-3 will produce 96 cubic feet of hydrogen in 15 to 25 minutes.
- (2) *Generating cycle.* The time required for generating gas, changing water, and preparing new charges is from 30 to 40 minutes.

## 5. Components

*Note.* The lists of components in this paragraph are for information only. See SIG 7 and 8 AN/TMQ-3 and SIG 7 and 8 ML-303/TM for information pertaining to the requisitioning of spare parts.

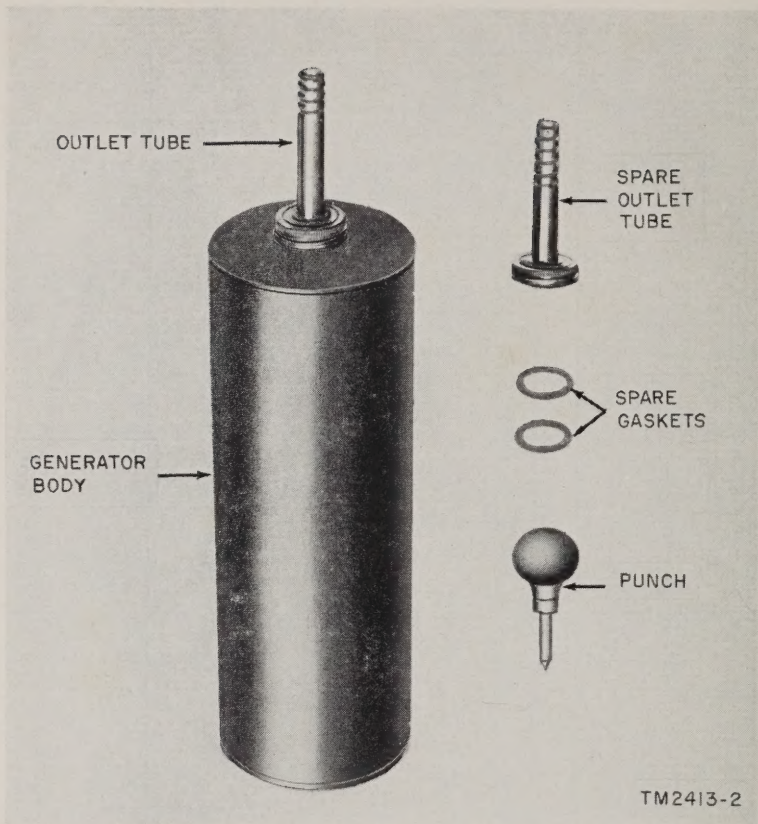
*a. Hydrogen Generator ML-303/TM.*

Component	Required No.	Dimensions (in)			Weight (lb)
		Height	Diameter	Length	
Generator body -----	1	15½	5⅛	-----	1.5
Outlet tube -----	1	3⅞	1¾	-----	
Gasket -----	1	-----	1¾	-----	
Punch -----	1	-----	1⅝	3¼	
Spare parts (par. 8a)----					



*b. Hydrogen Generator Set AN/TMQ-3.*

Component	Required No.	Dimensions (in)					Weight (lb)	Volume (cu ft)
		Height	Width	Depth	Length	Diameter		
Hydrogen Generator ML-303/TM (less punch and spare parts).	4	19				5½	1.6	2.3
Manifold ML-344/TMQ-3	1	11	11	11			2.3	
Hose ML-81	4				6	½ (inside diameter)		
Case CY-219/TMQ-3	1	18	27	12			32	3.5
Punch	1				3¼	1½		
Spare parts (par. 8b)								



*Figure 2. Hydrogen Generator ML-303/TM.*

## **6. Description of Hydrogen Generator ML-303/TM**

Hydrogen Generator ML-303/TM is shown in figure 2. The generator body is a cylindrical steel can. The outlet tube has a screw cap for attaching it to the generator body, and a corrugated stem to which Hose ML-81 may be attached. The bottom of the can (fig. 3) is recessed and has a protruding center with interrupter threads for attaching the chemical charge. The bottom of the can also has a number of holes to allow water to enter the generator body.

## **7. Description of Hydrogen Generator Set AN/TMQ-3**

Hydrogen Generator Set AN/TMQ-3 is shown in figure 4. The manifold consists of a steel tube welded to a square sheet iron

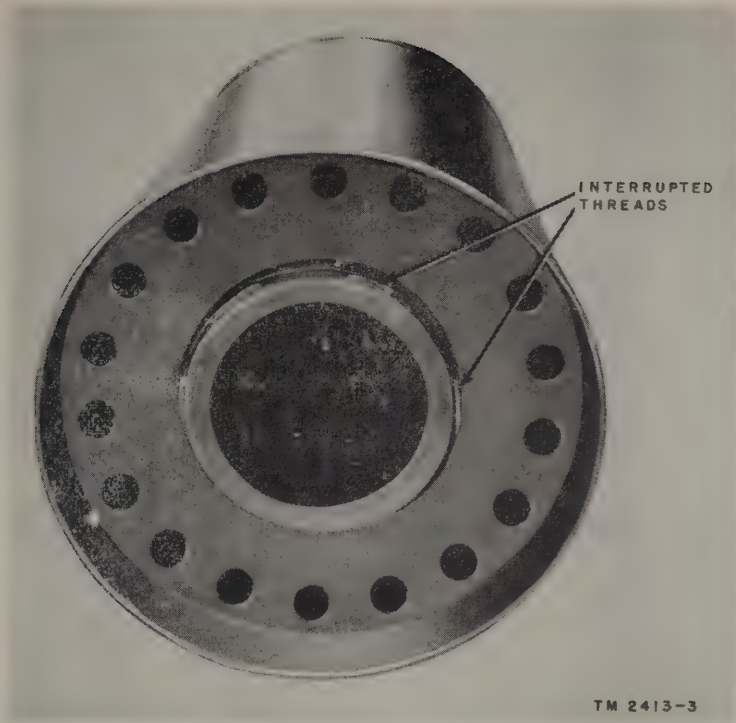


Figure 3. Generator body, bottom view.

plate. The plate has four holes for mounting the hydrogen generators, Short branch tubes connect Hoses ML-81 from each generator to the manifold. Case CY-219/TMQ-3 is fitted to hold the various components.

## 8. Spare Parts

a. *Hydrogen Generator ML-303 TM.* Hydrogen Generators ML-303/TM purchased on Order No. 19946-Phila-55 include one spare outlet tube and two spare gaskets. Equipment purchased on previous orders is not provided with spare parts.

b. *Hydrogen Generator Set AN/TMQ-3.* Hydrogen Generator Sets AN/TMQ-3 purchased on Order No. 21207-Phila-55 include the spare parts listed in the table below. Sets purchased on previous orders include the same spare parts except that the number of gaskets provided is six, and Hose ML-81 is provided in a 5-foot length.



Spare parts	Quantity
Hydrogen Generator ML-303/TM (less punch and spare parts)	2
Punch	1
Gaskets	8
Hose ML-81 (10-foot length)	1

## 9. Additional Equipment Required

The equipment discussed in *a* through *d* below is required for operation of Hydrogen Generator ML-303 TM and Hydrogen Generator Set AN/TMQ-3.

*a. Calcium Hydride Charge ML-304A TM and ML-305A/TM (fig. 5).*

- (1) Calcium Hydride Charge ML-304A TM is an airtight metal can containing approximately 6 ounces of 90-percent pure calcium hydride. The can is  $3\frac{3}{4}$  inches in diameter, and 2 inches high. The top of the can is recessed and is provided with interrupted threads for attaching the charge to the bottom of the generator body. On the top of the can there are a number of knockouts that can be removed to allow water to enter the can. The charge

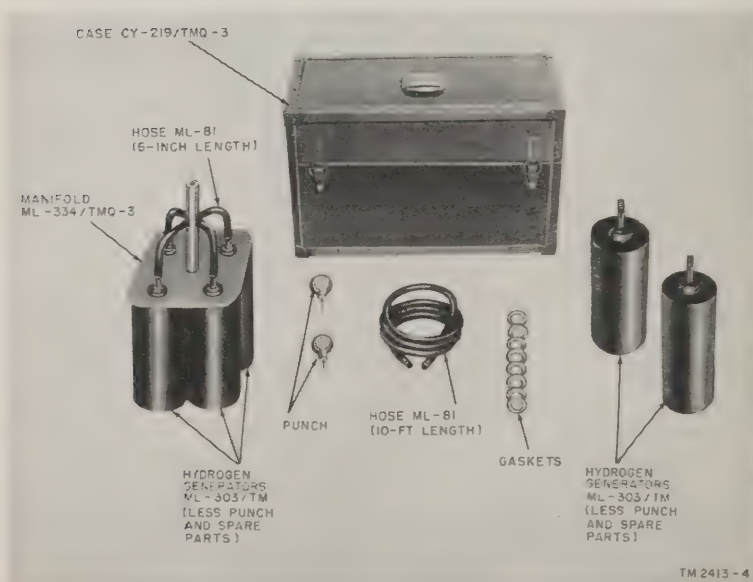


Figure 4. Hydrogen Generator Set AN/TMQ-3.

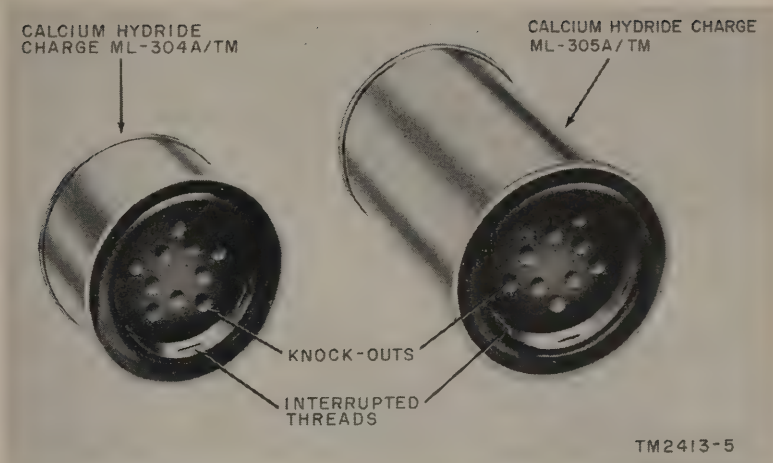


Figure 5. Calcium Hydride Charges ML-304A/TM and ML-305A/TM.

will produce approximately 6 cubic feet of hydrogen for inflation of a 30-gram balloon.

- (2) Calcium Hydride Charge ML-305A/TM is the same as Calcium Hydride Charge ML-304A/TM ((1) above) except that it contains approximately  $1\frac{1}{2}$  pounds of 90-percent pure calcium hydride, is  $6\frac{3}{4}$  inches high, and produces approximately 24 cubic feet of hydrogen for inflation of a 100-gram balloon.

*b. Balloon Nozzle ML-373, GM.* Balloon Nozzle ML-373/GM is required for inflation of small balloons. Refer to TM 11-2405, Meteorological Balloons, for information regarding this nozzle.

*c. Water Containers.* Water containers, preferably of metal, are required as indicated below:

- (1) A container having the minimum dimensions of 25 inches in height and 10 inches in diameter is required when Hydrogen Generator ML-303/TM is used.
- (2) A container having the minimum dimensions of 25 inches in height and 20 inches in diameter is required when Hydrogen Generator Set AN/TMQ-3 is used.

*d. Hose ML-81.* When only Hydrogen Generator ML-303/TM is available, a 5- to 10-foot length of Hose ML-81 is required as additional equipment because no inflation hose is included with the generator.

## CHAPTER 2

# INSTALLATION AND OPERATION

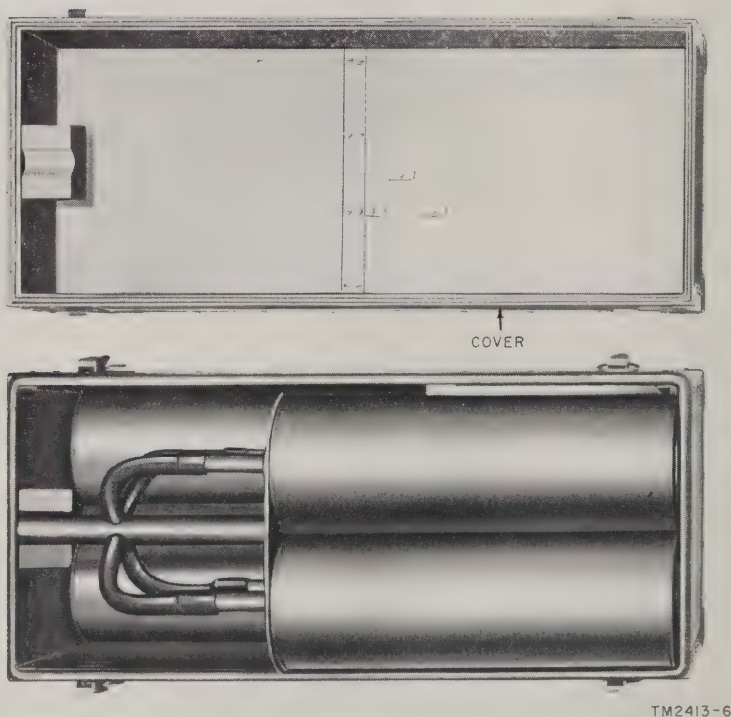
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### Section I. INSTALLATION

#### 10. Unpacking Equipment

##### *a. Packaging Data.*

- (1) *Hydrogen Generator ML-303, TM.* All components are packed in a water-resistant fiberboard box with flexible, corrugated fiberboard to prevent movement. The fiberboard box is then sealed and inclosed in a nailed wooden shipping box. For export shipment, the shipping box is banded with steel strapping.



*Figure 6. Hydrogen Generator Set AN/TMQ-3 in Case CY-219/TMQ-3 with cover of case removed.*



(2) *Hydrogen Generator Set AN/TMQ-3.* The components are placed in their compartments in Case CY-219/TMQ-3 (fig. 6) and the case is closed and secured with its latches. The case is placed in a water-resistant fiberboard box, which is then sealed. The sealed fiberboard box is then inclosed in a nailed wooden shipping box. For export shipment, the shipping box is banded with steel strapping.

(3) *Dimensions, volume, and weight of packed equipment.*

Equipment	Height (in)	Width (in)	Depth (in)	Volume (cu ft)	Weight (lb)
Hydrogen Generator ML-303/TM.	20	6	6	.4	3
Hydrogen Generator Set AN/TMQ-3.	20	30	15	5.0	45

*b. Removing Contents.* Cut and remove the steel strapping if the equipment is packed for export shipment. Carefully open the wooden shipping box and the fiberboard box. Do not push unpacking tools through the boxes, because the equipment may be damaged. Remove the equipment from the fiberboard box. In the case of Hydrogen Generator Set AN/TMQ-3, open the case and remove the contents.

## 11. Checking Equipment Before Use

*a. Checking Hydrogen Generator ML-303/TM.* Check all components against the packing slip.

*b. Checking Hydrogen Generator Set AN/TMQ-3.*

- (1) Check Manifold ML-344/TMQ-3 for cracks or breaks.
- (2) Check the 6-inch lengths of Hose ML-81 for cracks or breaks. and for proper attachment to the manifold and outlet tubes.
- (3) Unscrew the generator bodies from the outlet tubes; check the outlet tube gaskets; check the generator bodies for cracks or breaks; replace the generator bodies. Be sure that the outlet tubes fit tightly on the necks of the generator bodies and that the outlet tubes are not clamped against the manifold plate.
- (4) Check for the presence and good condition of the accessories (par. 5b) and spare parts (par. 8b).

## 12. Siting

Hydrogen Generator ML-303 TM and Hydrogen Generator Set AN TMQ-3 should be installed as near as possible to the site where

the balloons are to be released. The installation should also be located near a water supply and in an area having good drainage for the disposal of water and waste chemicals.

### 13. Preparation for Use

#### *a. Hydrogen Generator ML-303/TM.*

- (1) Obtain a container (par. 9c(1)).
- (2) Fill the container with fresh water to a depth of 22 inches. If fresh water is not available, salt water may be used. The water should be as cool as possible; the temperature of the water must not be over 85° F.
- (3) Be sure that the gasket is in place inside the screw cap, and that the outlet tube is screwed tightly on the threaded neck of the generator body.
- (4) Attach the balloon to be inflated to the injector on Balloon Nozzle ML-373 GM. Open the valve on the nozzle, roll up the balloon to expel the air, and close the valve.
- (5) Attach one end of the long length of Hose ML-81 to the outlet tube on the generator body.
- (6) Select the proper calcium hydride charge (par. 9a).
- (7) Follow the procedure given below to open the knockouts on the top of the calcium hydride charge can.

*Note.* Never punch out the knockouts on the charge can until the charge is to be used because the calcium hydride will begin to deteriorate when air enters the can.

- (a) Shake the charge can gently to settle the calcium hydride so that there will be no lumps against the top of the can that may interfere with the removal of the knockouts.

**Caution:** There may be some pressure within the charge can. Unless precautions are taken before removing the first knockout, this pressure may blow calcium hydride dust into your face and may injure your eyes. Carefully follow the procedures given in (b) and (c) below.

- (b) Wrap a piece of paper or a cloth around the punch so that the top of the charge can will be completely covered when the first knockout is removed.
- (c) Place the point of the punch on one of the knockouts, hold the paper or cloth against the top of the charge can, and force the punch through the knockout.
- (d) Remove the paper or cloth and punch out the remaining knockouts.

- (e) Be sure that the knockouts are punched out completely, and that the calcium hydride lumps do not block the openings. If necessary, shake the can to settle the calcium hydride enough to clear the openings.
- (8) Attach the calcium hydride charge can to the bottom of the generator body by engaging the interrupted threads (figs. 3 and 5) and then rotating the charge can a short turn.

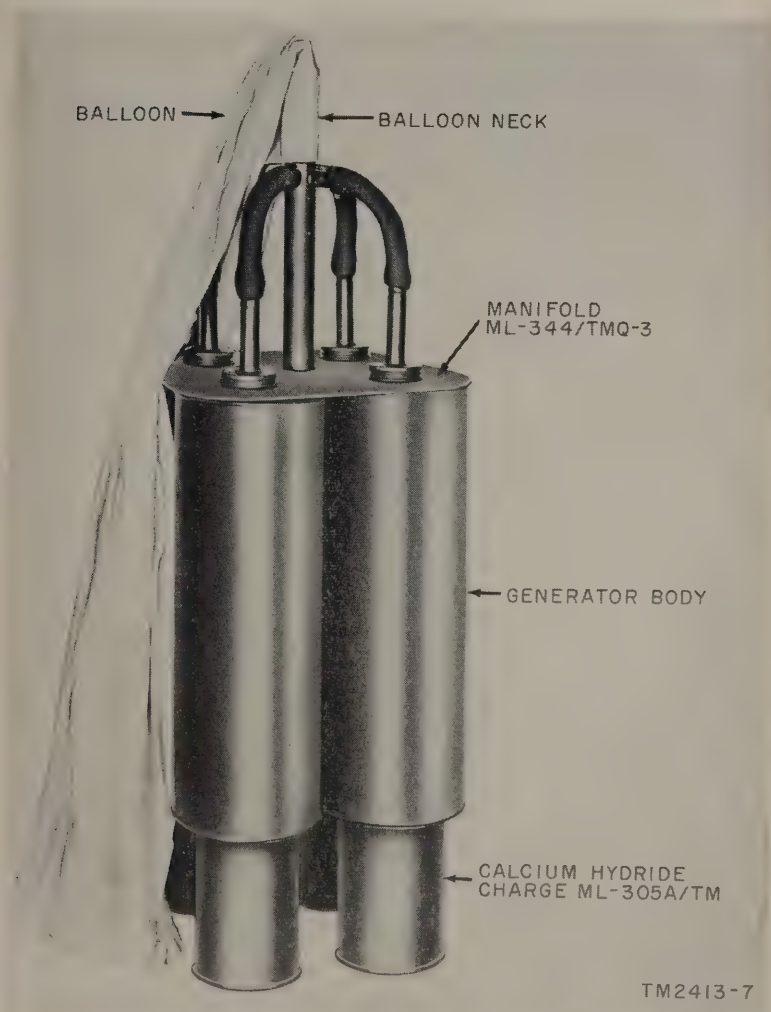


Figure 7. Hydrogen Generator Set AN/TMQ-3 prepared for use.



*b. Hydrogen Generator Set AN/TMQ-3.*

- (1) Obtain a container (par. 9c(2)).
- (2) Follow the procedure given in *a*(2) above.
- (3) Select the proper calcium hydride charges (par. 4) necessary to generate the number of cubic feet of hydrogen required. The amount of hydrogen required depends on the type and use of the balloon to be inflated as described in TM 11-2405.
- (4) Follow the procedure given in *a*(7) above for each calcium hydride charge being used.
- (5) Follow the procedure given in *a*(8) above for each generator being used.

*Note.* The four generators must remain assembled on the manifold during operation even though less than four calcium hydride charges are used. The water that enters the unused generator will prevent the escape of hydrogen from the unused manifold tube.

- (6) Pull the neck of the balloon to be inflated over the outlet on Manifold ML-344 TMQ-3 (fig. 7). Tie the balloon securely on the outlet with twine if the neck fits loosely.

## Section II. OPERATION

### 14. Precautions

*a.* Hydrogen is a flammable gas and can be highly explosive when mixed with air. Never smoke near a hydrogen generator when it is in operation, and keep all flames and sources of sparks away from the hydrogen generating area.

*b.* Never remove the hydrogen generator from the water until the generation of hydrogen has stopped. If a balloon breaks during inflation, or if for any other reason inflation must be interrupted, keep the generator in the water until the calcium hydride is completely exhausted. Removing the generator from the water while in operation will produce excessive heat and may cause dangerous chemical reaction.

*c.* Ground the equipment as explained in TM 11-2405.

*d.* When operating Hydrogen Generator ML-303 TM or Hydrogen Generator Set AN TMQ-3, all outer clothing and the gloves (*e* below) worn by the operator should be of a material that will not produce static electricity, because a static charge may produce a spark which will ignite the hydrogen gas. If other types of clothing must be worn, the operator should wear a grounding device as explained in TM 11-2405.

*e.* When operating Hydrogen Generator ML-303 TM or Hydrogen Generator Set AN TMQ-3, wear gloves to protect the hands,

because the outlet tube or manifold may become hot if a blow-back condition (par. 15a(2)) occurs.

f. When using Balloon Nozzle ML-373/GM, be sure that there is no obstruction in the nozzle. If there is any interference with the passing of the hydrogen into the balloon, a blow-back condition (par. 15a(2)) may occur.

g. Be sure there is no constriction in the balloon neck while the balloon is being inflated.

## 15. Operation Under Usual Conditions

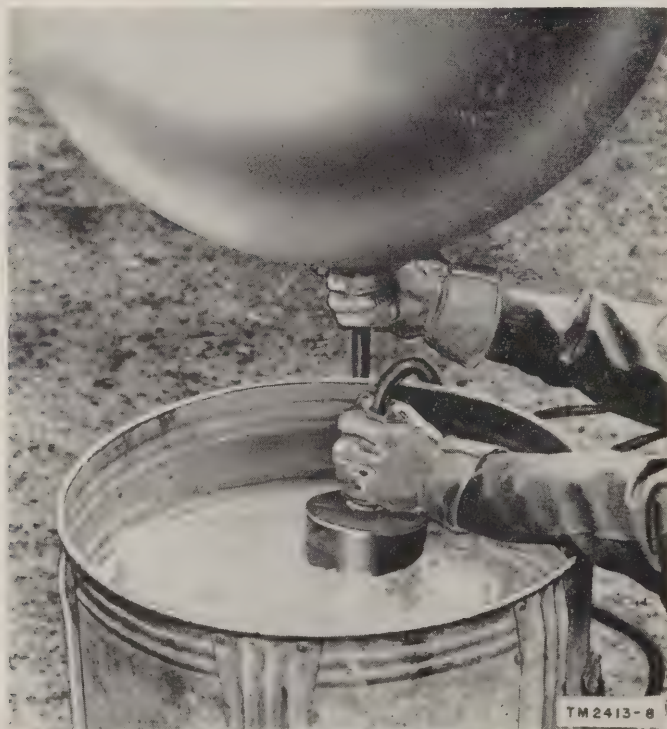
### a. *Hydrogen Generator ML-303/TM.*

- (1) Grasp the outlet tube of the generator and immerse the generator body rapidly in the water so that the top rim of the generator body is 2 inches above the surface of the water (fig. 8); hold it in this position throughout the generating process, except as indicated in (2) below, to prevent water from being blown through the outlet tube. A slight vibration should be noticed, indicating that hydrogen is being generated.
- (2) In some cases hydrogen may escape from the bottom of the generator; this condition is called a blow back.
  - (a) When a blow back occurs, lower the generator so that the top rim of the generator is below the surface of the water.
  - (b) As soon as the blow back stops, raise the generator to the position described in (1) above.
- (3) Allow the hydrogen to pass through the generator body, outlet tube, and Hose ML-81 for about 3 seconds to remove all air from inside these parts; when all air has been removed, open the valve on Balloon Nozzle ML-373/GM to which the balloon is attached, and attach the end of the hose to the balloon nozzle.
- (4) Move the generator 2 or 3 inches up and down in the water to agitate the water in contact with the chemical charge. This supplies fresher, cooler water to the chemical, thereby keeping the hydrogen cooler and stimulating the chemical action.
  - (a) If the hydrogen is being generated too fast, decrease the speed of agitation.
  - (b) If the hydrogen is being generated too slowly, increase the speed of agitation.
- (5) If the calcium hydride charge is defective and does not produce the hydrogen properly, remove the charge can under water and discard it in water. Prepare and install a new charge as described in paragraph 13a(6) through

(8), and repeat the procedure described in (1) through (4) above.

**Caution:** When removing the charge can, do not allow metal parts to strike each other. This may cause sparks. Be careful when handling the defective charge can. It may be very hot. Deposit the defective charge can in water quickly. When exposed to the air the charge may get extremely hot and the chemical may erupt.

- (6) When the vibration stops and it is certain that the chemical action has been completed, hold the equipment in its operating position for 5 to 10 minutes to allow the water and sediment to drain from the balloon.
- (7) When all of the water and sediment have drained from the balloon, close the valve on Balloon Nozzle ML-373/GM and detach Hose ML-81 from the nozzle.
- (8) Weigh off and tie the balloon securely as described in TM 11-2405.



*Figure 8. Hydrogen Generator ML-303/TM in operation.*



- (9) Remove the generator from the water and rinse the inside of the generator body with water to remove the waste chemical products. These waste products are not injurious to the skin or clothing.
- (10) After 10 to 12 generations using Calcium Hydride Charge ML-304A/TM, or 5 to 7 generations using Calcium Hydride Charge ML-305A/TM, change the water in the container to remove the waste chemical products which retard the chemical action.

*b. Hydrogen Generator Set AN/TMQ-3.*

- (1) Grasp the outlet tube of Manifold ML-344/TMQ-3 and immerse the generator in the water so that the top rims of the generator bodies are 2 inches above the surface of the water (fig. 1) ; hold it in this position throughout the generating process, to prevent water from being blown through the outlet tube. A vibration should be noticed indicating that hydrogen is being generated.
- (2) Be sure that the neck of the balloon is not twisted or pinched. Any interference with the passage of the hydrogen through the neck of the balloon will cause the hydrogen to escape from the bottom of the generator.
- (3) Follow the procedure in *a*(4) and (6) above.
- (4) When all the water and sediment have drained from the balloon, twist and hold its neck to prevent the escape of hydrogen, remove the balloon from the manifold, and tie it off as described in TM 11-2405. If it is desired to weigh off the balloon, attach the neck of the balloon to Nozzle ML-196 immediately after removing it from the manifold, and weigh off as described in TM 11-2405.
- (5) Remove the generator from the water and rinse the inside of the generator bodies, the manifold, and the four short lengths of hose, using water to remove the waste chemical products. These waste products are not injurious to the skin or clothing.
- (6) Change the water in the container after each generation of hydrogen to remove waste chemical products, which retard the chemical action.

## **16. Operation Under Unusual Conditions**

*a. Operation of Hydrogen Generator ML-303/TM in Extreme Cold.* When operating Hydrogen Generator ML-303/TM in extreme cold, the water vapor in the generated hydrogen will freeze and form snow as it passes through Hose ML-81 if the regular length of hose is used. This snow will accumulate in the balloon nozzle and block the passage of hydrogen. To prevent this condi-

tion, cut off approximately 6 inches from Hose ML-81 and use this short length of hose instead of the regular length.

*b. Operation When Water is Difficult to Obtain.*

- (1) When the water is to be changed (par. 15a(10) and b(6)) allow it to stand for about 2 hours while using a second container of water for operation.
- (2) When the waste chemicals in the first container have settled, pour the clear water into a temporary container, clean the first container, and replace the water.

*c. Operation Without Water Container.* When a water container is not available, or when it is expedient, Hydrogen Generator ML-303/TM or Hydrogen Generator Set AN/TMQ-3 may be operated in a stream, brook, or other suitable body of water.

## CHAPTER 3

### ORGANIZATIONAL MAINTENANCE

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#### Section I. OPERATOR'S MAINTENANCE

##### 17. General

Operator's maintenance of Hydrogen Generator ML-303/TM and Hydrogen Generator Set AN/TMQ-3 consists of inspecting and cleaning the equipment and replacing minor parts. A supply of water, clean cloths, a knife, and a narrow wooden stick for cleaning the small holes in the generator parts are required.

##### 18. Performing Operator's Maintenance

The operator will perform the following maintenance monthly:

*a. Hydrogen Generator ML-303/TM.*

- (1) Remove the outlet tube and gasket from the generator body.
- (2) Inspect all interior and exterior parts of the generator for chemical deposits and dirt. Remove any deposits and dirt found. Rinse all parts of the generator with water, and wipe the equipment dry.
- (3) Replace the gasket and screw the outlet tube tightly on the generator body.

*b. Hydrogen Generator Set AN/TMQ-3.*

- (1) Remove the four short lengths of Hose ML-81 from the manifold and from the outlet tubes. Remove the four outlet tubes and the four gaskets from the generator bodies, and remove the generator bodies from the manifold.
- (2) Inspect all interior and exterior parts of the generator for chemical deposits and dirt. Remove any deposits and dirt found. Rinse all parts of the generator with water, and wipe the equipment dry.
- (3) Replace the generator bodies, gaskets, outlet tubes, and hoses on the manifold. Be sure that the outlet tubes fit tightly on the necks of the generator bodies and that the outlet tubes are not clamped against the manifold plate.
- (4) If any of the short lengths of hose are unserviceable, cut a 6-inch length from the long length of Hose ML-81 supplied with the equipment, to replace the unserviceable hose.

## Section II. REPAIRMAN'S MAINTENANCE

### 19. General

Repairman's maintenance of Hydrogen Generator ML-303 TM and Hydrogen Generator Set AN/TMQ-3 consists of removing rust and corrosion from the equipment and retouching the equipment with paint where the finish has been damaged. The only maintenance equipment required is fine sandpaper and appropriate pointing materials.

### 20. Performing Repairman's Maintenance

*a.* Disassemble the equipment as described in paragraph 18*a* (1) or *b* (1).

*b.* Inspect all metal parts of the equipment and remove any rust, corrosion, or dirt found. Use fine sandpaper for the removal of rust or corrosion.

*c.* Retouch any places on the equipment with paint where the finish has been damaged. Refer to TM 9-2851, Painting Instructions for Field Use, for the procedure to be used when painting metal surfaces.

*d.* Reassemble the equipment as described in paragraph 18*a* (3) or *b* (3).



## CHAPTER 4

### THEORY

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#### 21. Generator Action

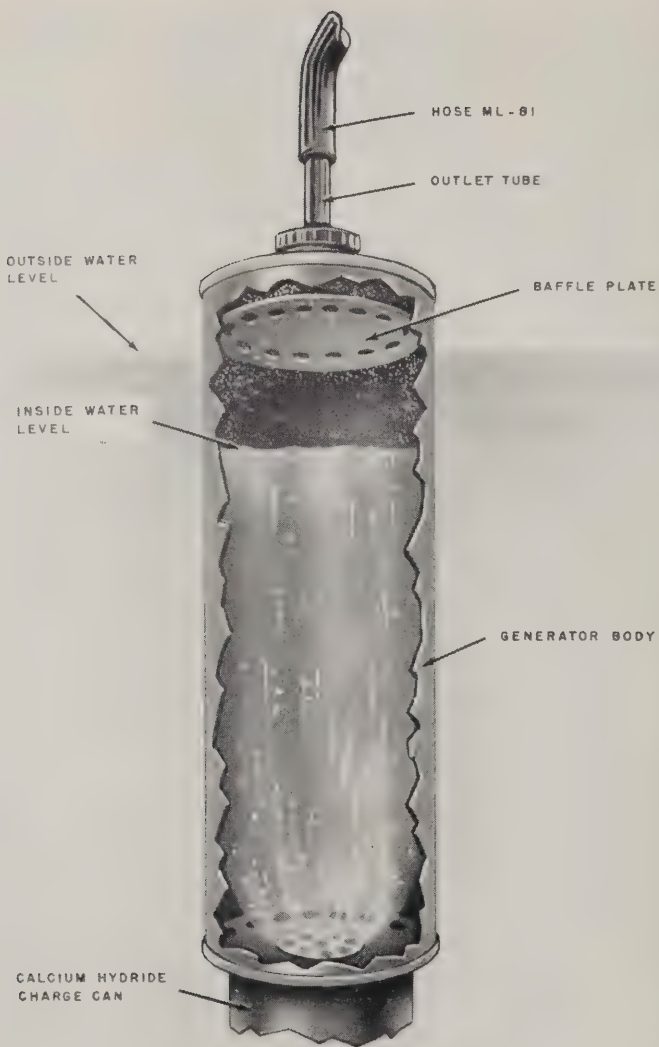
*a. Hydrogen Generator ML-303/TM (fig. 9).* When the generator is placed in the water, the water enters the generator through the holes in the bottom of the generator body and rises to the same level as the outside water. The water also enters the calcium hydride charge can through the knockout holes in the top of the can and reacts with the calcium hydride to form hydrogen gas. The hydrogen gas escapes through the holes in the top of the charge can and rises through the water to the top of the generator body. The gas then passes through the holes in the baffle plate, through the outlet tube, Hose ML-81, Balloon Nozzle ML-373/GM, and into the balloon. The outlet tube provides a narrow passage for the gas and therefore a pressure is created in the top of the generator body which forces the water inside the generator body down below the level of the outside water. The baffle plate prevents the passage of excessive water and waste chemicals from being carried through the outlet tube and into the balloon.

*b. Hydrogen Generator Set AN/TMQ-3.* The theory of Hydrogen Generator Set AN/TMQ-3 is the same as the theory described in *a* above except that when the hydrogen gas leaves the outlet tubes on the generator bodies, it passes through the short lengths of hose, through the outlet tube on Manifold ML-344/TM, and into the balloon.

#### 22. Chemical Action

*a.* When the water comes into contact with the calcium hydride, a chemical reaction takes place which produces hydrogen gas and calcium hydroxide. The hydrogen passes through the generator and into the balloon as explained in paragraph 21. The calcium hydroxide is released in the water, causing the water to become cloudy. Some of the calcium hydroxide collects on the inner and outer surfaces of the generator, and the rest slowly settles at the bottom of the water container.

*b.* During the chemical reaction, a great amount of heat is produced in the calcium hydride charge can. Some of the heat is released in the water, and some is passed through the generator and causes the outlet tube to become hot.



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*Figure 9. Generator action.*

c. When the generator is removed from the water, the calcium hydroxide which collected on the various surfaces (*a* above) reacts with the carbon dioxide in the air to form calcium carbonate which is very hard. If the equipment is not cleaned before the various surfaces dry, the calcium carbonate will stick to the surfaces, clog the small openings, and become difficult to remove.

## **CHAPTER 5**

### **FIELD MAINTENANCE**

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#### **23. Troubleshooting Hydrogen Generator ML-303/TM**

- a.* Be sure the outlet tube and gasket are firmly in place on the generator body.
- b.* Plug the top of the outlet tube to prevent the escape of air.
- c.* Immerse the generator body and outlet tube vertically in water with the outlet tube upward.
- d.* Any leaks in the equipment will be indicated by a stream of air bubbles rising from the location of the leak.

#### **24. Troubleshooting Hydrogen Generator Set AN/TMQ-3**

- a.* Be sure the generator is properly assembled (par. 18*b*(3)).
- b.* Plug the top of the outlet tube on Manifold ML-344 TMQ-3 to prevent the escape of air.
- c.* Immerse the assembly vertically in water with the outlet tube of the manifold upward.
- d.* Leaks will be indicated as in paragraph 23*d*.

#### **25. Repairs, General**

- a.* Refer to paragraphs 18 and 20 for minor maintenance procedures and disassembly and reassembly instructions.
- b.* If any part of the equipment is damaged beyond repair, replace the damaged part with a new one.

#### **26. Repairing Leaks**

- a.* Repair small holes with solder. Repair large holes by soldering a piece of sheet metal over the hole.
- b.* If a leak is caused by a defective gasket, replace the gasket with a new one.

#### **27. Visual Inspection**

Visually inspect the equipment for evidence of damage and improper assembly. Check all outlet tubes for gaskets and for secure attachment to the generator bodies.

#### **28. Leakage Test**

When the equipment has been repaired, repainted, and reassembled, repeat the procedure in paragraph 23 or 24.



## CHAPTER 6

# SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

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### Section I. SHIPMENT AND LIMITED STORAGE

#### 29. General

When Hydrogen Generator ML-303/TM or Hydrogen Generator Set AN/TMQ-3 is to be shipped or placed in limited storage, pack the equipment so that it will not be damaged by severe jolting or adverse weather conditions. Use a packing case strong enough to protect the equipment according to the type of transportation or storage to be used.

#### 30. Repacking

Pack Hydrogen Generator ML-303/TM or Hydrogen Generator Set AN/TMQ-3 in accordance with the packaging data in paragraph 10a. Use the original packing material if available or use similar material. Further repacking information is usually available at supply depots.

### Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

#### 31. General

Demolition of Hydrogen Generator ML-303/TM or Hydrogen Generator Set AN/TMQ-3 will be accomplished only upon order of the proper authority. The demolition procedures in paragraph 32 will be used to prevent the enemy from using or salvaging the equipment or any of its parts.

#### 32. Methods of Destruction

Use any or all of the following methods to destroy Hydrogen Generator ML-303/TM, Hydrogen Generator Set AN/TMQ-3, and the additional equipment:

*a. Smash.* Smash the generator bodies, outlet tubes, manifold, case, punches, water container, and balloon nozzle; use sledges, axes, or other heavy tools.

*b. Cut.* Cut the hoses and gaskets; use axes, knives, machetes, or shears.

*c. Burn.* Burn the hoses, gaskets, case, punches, and technical manuals; use oil, kerosene, or gasoline.

**Warning:** Gasoline vaporizes rapidly and may explode when lighted, causing injury or death to near-by personnel. When setting fire to gasoline-soaked material, stand away from the material and throw a lighted torch into it.

*d. Dispose.* Bury the destroyed parts in trenches, foxholes, or other holes, or throw the destroyed parts into streams, rivers, or lakes. Open the calcium hydride charge cans and dispose of them in water in an open area.

BY ORDER OF THE SECRETARIES OF THE ARMY AND THE  
AIR FORCE:

MAXWELL D. TAYLOR,  
*General, United States Army,*  
*Chief of Staff.*

OFFICIAL:

JOHN A. KLEIN,  
*Major General, United States Army,*  
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Sig Depots (17)	(2)
US Army Tng Cen (2)	

NG: State AG (6); units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see SR 320-50-1.











TM 11-2413/TO 31M1-2TM-121-HYDROGEN GENERATOR ML-303/TM AND HYDROGEN  
GENERATOR SET AN/TMQ-3-1956